

Digital Pressure Gauge

DPG 2400





Warning

This Warning symbol indicates that danger of injury for persons and the environment and/or considerable damage (mortal danger, danger of injury) will occur if the respective safety precautions are not taken.



Caution

This Caution symbol indicates danger for the system and material if the respective safety precautions are not taken.



Notice

This Notice symbol does not indicate safety notices but information for a better understanding of the facts.

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1. General Information

1.1 Warranty

All products manufactured by Mensor® Corporation (Mensor) are warranted to be free of defects in workmanship and materials for a period of one year from the date of shipment. No other express warranty is given, and no affirmation of Seller, by words or actions, shall constitute a warranty. SELLER DISCLAIMS ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSES WHATSOEVER. If any defect in workmanship or material should develop under conditions of normal use and service within the warranty period, repairs will be made at no charge to the original purchaser, upon delivery of the product(s) to the factory, shipping charges prepaid. If inspection by Mensor or its authorized representative reveals that the product was damaged by accident, alteration, misuse, abuse, faulty installation or other causes beyond the control of Mensor, this warranty does not apply. The judgment of Mensor will be final as to all matters concerning condition of the product, the cause and nature of a defect, and the necessity or manner of repair. Service, repairs or disassembly of the product in any manner, performed without specific factory permission, voids this warranty.

MENSOR MAKES NO WARRANTY OF ANY KIND WITH REGARD TO THIS MANUAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Mensor shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

1.2 Important Notice

The product specifications and other information contained in this manual are subject to change without notice.

Mensor has made a concerted effort to provide complete and current information for the proper use of the equipment. If there are questions regarding this manual or the proper use of the equipment, contact Mensor at:

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San Marcos, Tx 78666
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E-Mail: testequip@wika.de

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1.3 Software License Agreement

This product contains intellectual property, i.e., software programs, that are licensed for use by the end user/customer (hereinafter “end user”).

This is not a sale of such intellectual property.

The end user shall not copy, disassemble or reverse compile the software program.

The software programs are provided to the end user “as is” without warranty of any kind, either express or implied, including, but not limited to, warranties of merchantability and fitness for a particular purpose. The entire risk of the quality and performance of the software program is with the end user.

Mensor and its suppliers shall not be held to any liability for any damages suffered or incurred by the end user (including, but not limited to, general, special, consequential or incidental damages including damages for loss of business profits, business interruption, loss of business information and the like), arising from or in connection with the delivery, use or performance of the software program.

1.4 Mensor Service Plus

If you have problems and you don't find the answer in this manual, contact Mensor at 1.800.984.4200 (USA only) or 1.512.396.4200 for personal assistance, or at any of the contact addresses listed on the rear cover of this manual. We are ready to help.

1.4.1 After the Warranty

Mensor's concern with the performance of this instrument is not limited to the warranty period. We provide complete repair, calibration and certification services after the warranty for a nominal fee.

1.4.2 Calibration Services

In addition to servicing our own products Mensor can perform a complete pressure calibration service, up to 20,000 psi, for all of your pressure instruments. This service includes an accredited calibration.

1.4.3 Accreditations

Mensor Corporation is registered to ISO 9001:2008. The calibration program at Mensor is accredited by A2LA, as complying with both the ISO/IEC 17025:2005 and the ANSI/NCSL Z540-1-1994 standards.

2. Safety Notices

2.1 Warnings and Caution Notices



Warning

WARNING: NOT EXPLOSION PROOF!

Installation of this instrument in an area requiring devices rated as intrinsically safe is not recommended.



Caution

CAUTION: Some ranges require clean, non-corrosive pressure media. See “Media Compatibility” in Section 4, Specifications. This instrument is not designed for oxygen use.



Caution

CAUTION: Avoid excessive overpressure to the sensor! Externally mounted relief valves to provide overpressure protection are available from Mensor as optional devices.



Caution

CAUTION: Use of a power supply other than the one provided by Mensor will invalidate the warranty.



CAUTION: ESD PROTECTION REQUIRED. The proper use of grounded work surfaces and personal wrist straps are required when coming into contact with exposed circuits (printed circuit boards) to prevent static discharge to sensitive electronic components.

Additional notices are found throughout this manual.

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Notes

3. Product Description

3.1 General Description

The DPG 2400 is the lowest accuracy single-range pressure measuring instrument available in the Mensor DPG family. With an uncertainty of 0.03% FS, and a small package design, this unit is perfect for desk top monitoring of pressure changes and for use in Production and Test environments. Temperature compensation from 15 to 45 degree C permits use in this temperature range without degradation of accuracy.

The unique design of the DPG 2400 has modest features and simple menu options. It has a standard RS-232 serial output port that can be used for remote communications. It can display measured pressure along with peaks or null. Other features are a monochrome LCD display, null capability, a single silicon sensor and it is powered by a wall transformer.

Optional features include external dual differential relief valves, externally mounted relief valves, RS-485 communications, and a rack mount kit.

3.2 Display

Several different display screens are presented while operating the DPG 2400. Each screen is arranged into blocks of information, generally organized into columns and rows. These screens are each described in further detail in Section 6, "Local Operation", and in Section 7, "Remote Operation".

3.3 Power Supply

The power adapter is utilized to provide power to operate the DPG 2400. It produces 12 VDC @ 830 mA max.

3.4 Serial In/Out Communications

The serial port can be used to configure and calibrate the DPG 2400, or to read the output of its sensor. Depending on how your DPG 2400 was ordered, the instrument came with either RS-232 or RS-485 serial port communications. Both are explained below.

The RS-232 serial port is configured as 9600 baud, 8 data bits, 1 stop bit and no parity. It is designed as a 9-pin DCE device so that a straight pin to pin cable can be used to connect it to a standard PC serial port.

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The RS-485 serial port is configured for 4-wire plus ground connections. The port operates at 9600 baud, 8 data bits, 1 stop bit and no parity. The device address can be changed using a remote command.

Wiring requirements are provided in Section 5.4, “Electrical Connections”, and a list of valid commands and responses is provided in Section 7.2.5, “Commands and Queries”.

4. Specifications

Accuracy specifications presented herein are obtained by comparison with primary standards traceable to the National Institute of Standards and Technology (NIST). These specifications are obtained in accordance with the ISO *Guide to the Expression of Uncertainty in Measurement (GUM)*. The calibration program at Mensor is accredited by the American Association of Laboratory Accreditation (A2LA) as complying with both the ISO/IEC 17025:2005 and the ANSI/NC SL Z540-1-1994 standards.

Mensor reserves the right to change specifications without notice.

Total Uncertainty	Better than 0.03% FS for 180 days.
Calibration Interval	180 days
Pressure Ranges	7.5 to 6000 psia, 0.36 to 6000 psig.
Resolution	5 digits
Overpressure Limit	1.5X
Burst pressure Limit	3X up to 500 psig, 2X greater than 500 psig.
Compensated Temperature Range	15 to 45°C
Storage Temperature Range	-20 ... 70°C
Warm-up	<1 minute
Reading Rate	~4.6 / second
Response Time	<252 mS
Orientation Effects	Negligible >30 psi, zero offset resettable with zero cal or null function.
Communications	RS-232 or RS-485 fixed at 9600 baud, no parity, 8 data bits, 1 stop bit.
Case size	2.6" H x 4.2" W x 4.9" D (see Section 5.2, Dimensions)
Weight	<2 lbs.

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Media Compatibility	Pressure port: Clean, dry, non-corrosive, non-combustible, non-oxidizing gases for all rated ranges. Ranges ≥ 7.5 psi: All other media compatible with aluminum, 316 stainless steel, brass, Buna N, Viton, sealant, silicone grease and RTV. Not designed for oxygen service. Cannot guarantee accuracy on media other than gases. Reference port: Clean, dry, non-corrosive gases.
Power Consumption	12 VDC, .125A
Pressure Interfaces	7/16-20 SAE, Ref: 10-24, 1/8" and 1/4" FNPT adapters included. 1/16 inch hose barb for reference port.
Warranty	One year
Options	Relief valves for ranges >100 psi mounted externally. Rack mount kit.
Pressure Units	See Table 7.2.7, "Pressure Units Codes and Conversions".
Display	Monochrome 128 x64 LCD with white LED backlight.
Compliance	The DPG 2400 is compliant to the following CE Standards: EN 50081 and EN 50082.

5. Installation

5.1 Unpacking the Instrument

In addition to functional testing, each unit is inspected for appearance prior to leaving the factory. Upon receipt, please examine the transducer for shipping damage. Report any apparent damage to the carrier immediately.

In addition to this manual you should have:

- One DPG 2400 Digital Pressure Gauge;
- Power adapter;
- Any accessories ordered;
- An envelope containing the Calibration Certificate.

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5.2 Dimensions

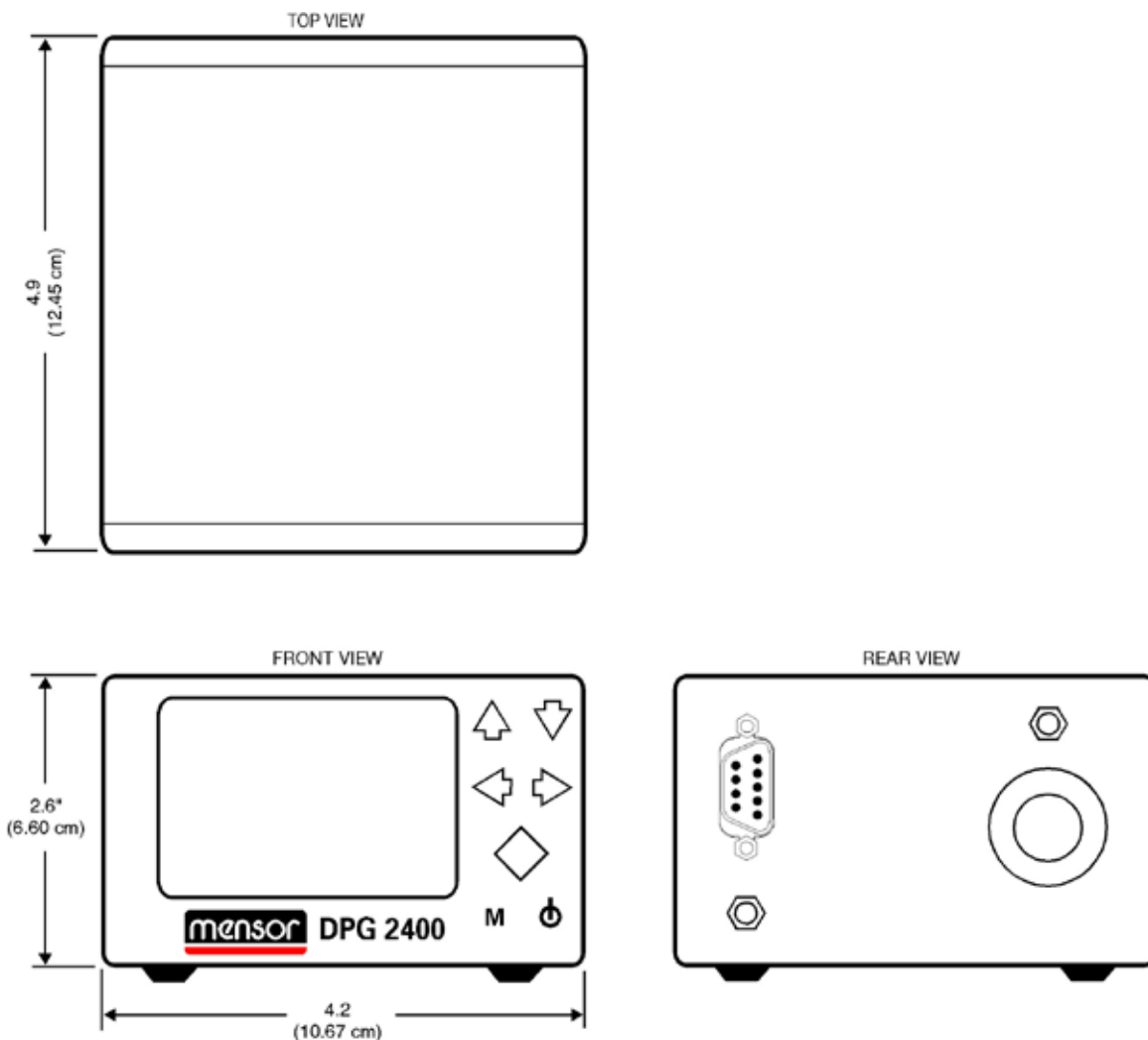


Figure 5.2 - Case Outline/Dimensions

5.3 Pressure Connections

The 7/16-20 SAE female NPT threaded port is the pressure input of the DPG 2400. If the sensor range is less than 20 psi and is a gauge or bi-directional sensor, there will also be a 1/16 inch hose barb fitting above the pressure port. The barb fitting provides access to the reference port of the sensor.



CAUTION: Avoid excessive overpressure to the sensor!
Externally mounted relief valves to provide overpressure protection are available from Mensor as optional devices.

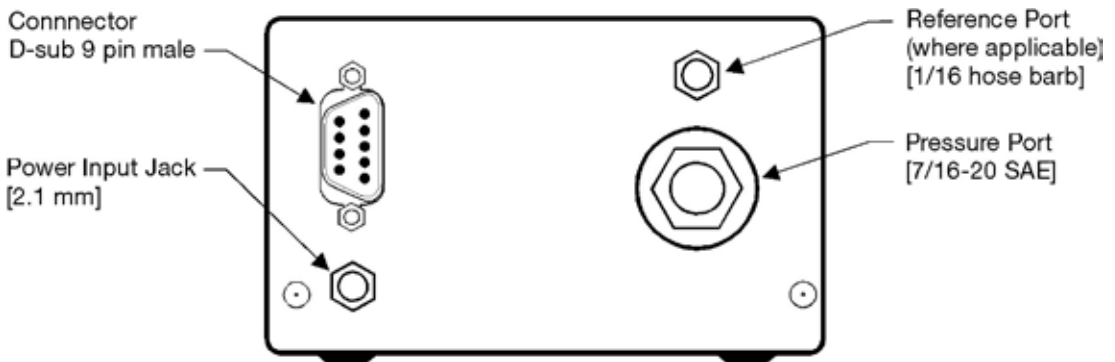


Figure 5.3 - Rear view of DPG 2400

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5.4 Electrical Connections

For RS-232 serial port operation, connect the DPG 2400 to the host computer per Figure 5.4a. Notice that the host TRANSMIT line is connected to the DPG 2400 RECEIVE line (TX to RX), and vice versa.

The power connector is a 2.1 mm standard power jack. The center pin is +12 VDC and the outside is ground (see Figure 5.4b).

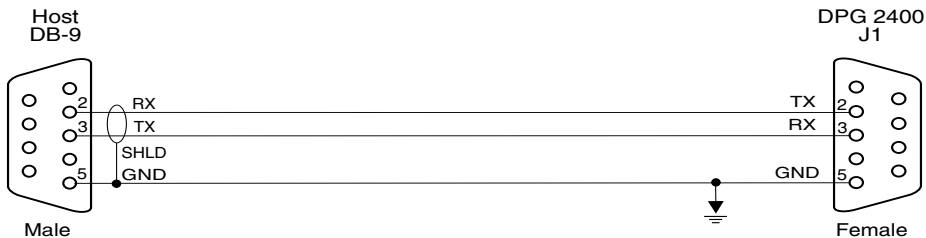


Figure 5.4a - RS-232 Hookup

For RS-485 serial port operation, connect the DPG 2400 to the host computer per Figure 5.4b.



Figure 5.4b - RS-485 Hookup

5.5 Power On

After the pressure connections are secure, press the power switch (⏻). The DPG 2400 will run through a brief initialization sequence and then will display a pressure reading.

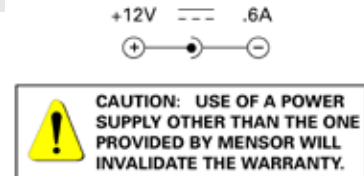


Figure 5.5 - DC Input

6. Local Operation

6.1 Keypad

A brief description of the keypad features and the display is provided below in Figure 6.1, "Keypad and Display Features".

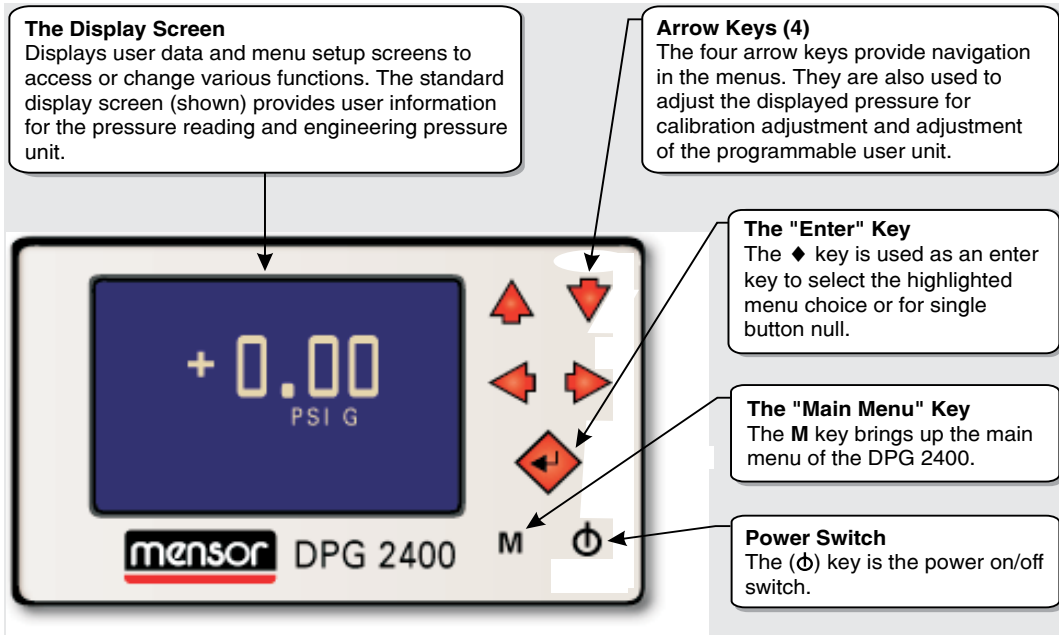


Figure 6.1 - Keypad and Display Features

6.2 Standard Display

When the DPG 2400 is powered on, a pressure reading will be displayed after the initialization screen.



Figure 6.2 - Display Screen (standard)

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6.3 Menu Screens

All the menu screens can be navigated by use of the arrow keys. To select a menu item, highlight the item and press the **◆** (enter) key.

6.3.1 Main Menu Screen

If the **M** (menu) key is pressed at any time, the main menu is displayed:

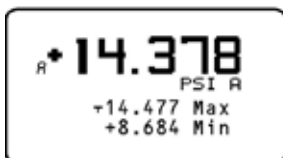
A Setup	
Peak Off	Peak Rst
Null Off	Cal
Units	Sensor A

The items in this menu perform the following functions when selected:

Peak Off (On): Toggles the peak indicator.

A Setup	
Peak On	Peak Rst
Null Off	Cal
Units	Sensor A

The current state of the peak indicator is highlighted. If the menu item displays “Peak Off”, the peak indicator is disabled. If “Peak On” is selected, it will enable peak capture. If the Sensor Setup menu is re-entered, the menu item will display “Peak On” to indicate that the peak capture function is enabled.



The peak indication screen will display current, maximum, and minimum pressures. The instrument will continuously update the peaks until “Peak Rst” is selected.

Peak Reset: Resets the peak values to the current measured pressure.

A Setup	
Peak On	Peak Rst
Null Off	Cal
Units	Sensor A

Null Off (On): Toggles the null function.

A Setup	
Peak Off	Peak Rst
Null On	Cal
Units	Sensor A

The current state of the null function is displayed. If the menu item displays “Null Off”, the null function is disabled. If “Null Off” is selected, the DPG 2400 will subtract the current measured pressure from any subsequent pressure readings. A capital “N” appears just above the “A” on the main operation screen to indicate that the sensor is currently using a null offset.

Single button null: The null feature can also be accessed by pressing the **◆** (enter) key while at the standard display. The null button will toggle nulling on or off. The instrument will revert to the un-nulled state if power is cycled.



Notice

- 1. Peak and Null functions can be used simultaneously.**
- 2. Pressure units must not be changed when using the null feature.**

Cal: Displays the calibration password entry screen.

A Setup	
Peak Off	Peak Rst
Null Off	Cal
Units	Sensor A

Sensor A Calibration Password Entry
0000
Enter to Continue

Units: Displays the first of the three pressure units screens.

PSI	InH ₂ O c
InH ₂ O 60f	InH ₂ O 4c
InH ₂ O 20c	mBAR
BAR	more

Sensor A: Returns to sensor display.

A Setup	
Peak Off	Peak Rst
Null Off	Cal
Units	Sensor A

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6.3.2 Password Entry Screen

If the calibration function is selected from the sensor setup screen, the password entry screen will be displayed:



The 4-digit password can be entered by moving the cursor with the left and right arrow keys under the digit to be changed and then pressing the up or down arrow keys to scroll through the numbers 0 to 9. When the password is entered, press the **◆** (enter) key. The calibration screen will be displayed.

6.3.3 Sensor Calibration Screen

The sensor calibration screen allows the zero and span to be adjusted, the calibration to be reset to the factory defaults, and the calibration password to be changed.

A Calibration	
Cal Zero	Cal Span
Change PW	Reset Cal

The items in the calibration menu perform the following functions when selected:

Cal Zero: Displays the currently measured pressure.

A Calibration	
Cal Zero	Cal Span
Change PW	Reset Cal

Adjust the digits to the true pressure applied to the sensor and press the **◆** (enter) key to store the value. For more details, see Section 8, Calibration.

Cal Span: Displays the measured pressure for the active sensor.

A Calibration	
Cal Zero	Cal Span
Change PW	Reset Cal

Adjust the digits to the true pressure applied to the sensor and press the **◆** (enter) key to store the value. For more details, see Section 8, Calibration.

Change PW:

A Calibration	
Cal Zero	Cal Span
Change PW	Reset Cal

Sensor A Calibration Password Entry 0000 Enter to Continue
--

Move the cursor with the left and right arrow keys under the digit to be changed. Increment the digit with the up arrow key and decrement the digit with the down arrow key. When the password has been changed, press the ♦ (enter) key to store it. The main menu is then displayed.



The password is set to “0000” at the factory. When making a change write it down and save the number. If the password is lost contact Mensor.

Reset Cal: Displays a confirmation screen.

A Calibration	
Cal Zero	Cal Span
Change PW	Reset Cal

Reset Calibration Sensor A Are you Sure? Enter to Reset Other Keys to Quit
--

If the ♦ (enter) key is pressed, the calibration is reset to the factory defaults and the main operation screen is displayed. If any other key is pressed, the main menu screen is displayed.

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6.3.4 Pressure Units Screens



Notice

Pressure units must not be changed when using the null feature.

There are three screens that allow selection of the most common pressure units:

PSI	InHs 0c
InHs 60f	InH20 4c
InH20 20c	mBAR
BAR	more

mmHs 0c	cmHs 0c
Pa	hPa
kPa	MPa
kg/cm ²	more

cmH20 4c	cmH20 20c
MSW	User
Set User	more

The pressure unit of the sensor is selected by highlighting the desired unit and pressing the \blacklozenge (enter) key. To advance to the next units screen, select “more”. The last units screen allows selection and entry of a special “User” unit. The User unit has a configurable conversion factor that converts from PSI to the desired value. To enter the conversion factor, select “Set User” on the last units screen to display:

Set User Units A
+1.00000e+1
Enter to Continue

Use the left and right arrow keys to move the cursor under the digit to change and use the up and down arrow keys to increment or decrement the digit. The conversion factor can be set from $-1.00000e+6$ to $-1.00000e-6$ and $+1.00000e-6$ to $+1.00000e+6$. Press the \blacklozenge (enter) key to store the conversion factor. To apply the “user” conversion factor, the units “User” must be selected.



Notice

For the remote programmable pressure units list and information, see Section 7.2.6, User Programmable Pressure Units.

6.4 Menu Tree

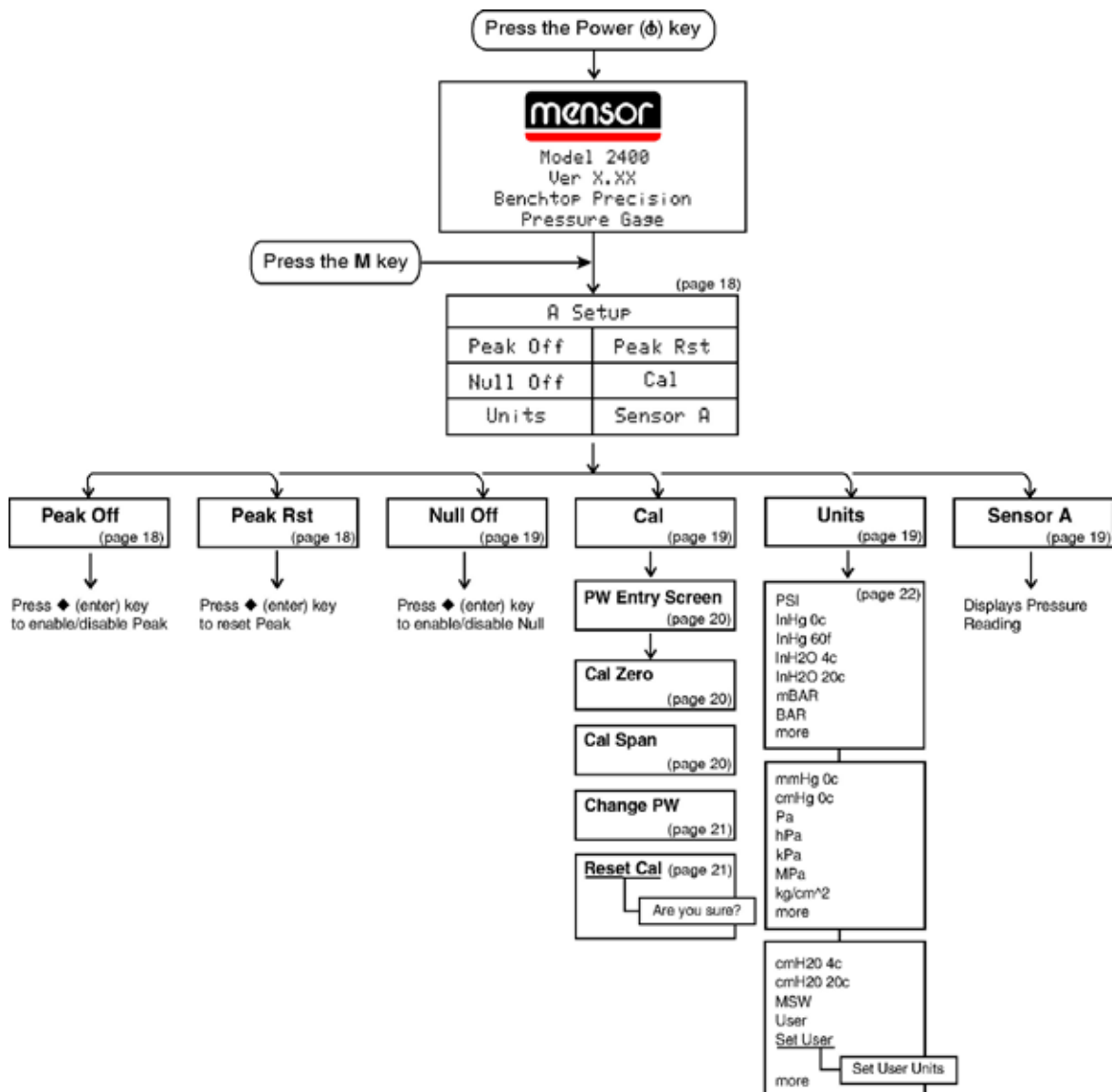


Figure 6.4 - DPG 2400 Menu Tree

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Notes

7. Remote Operation

7.1 General

The DPG 2400 can be operated from a remote computer which communicates over an RS-232 (standard) or RS-485 serial port. The serial port can be used to configure and calibrate the DPG 2400, or to read the output of its sensors. This section of the manual provides information on the serial port configuration, explains the command conventions used in this manual, and lists the common commands and queries which are recognized by the DPG 2400.

7.2 Communication Syntax

All commands and responses are in ASCII characters; lower and upper case are interpreted the same. Every command or query begins with the pound symbol (#). The question mark (?) character is significant to the DPG 2400. All other punctuation characters are ignored. Some commands require a password string. A carriage return (<cr>) or linefeed (<lf>) must terminate each command or query. The global address character is an asterisk (*). It can be sent in place of the actual DPG 2400 address. See Table 7.2 for “Command Conventions” and Table 7.2.5 for “Command Set”.

Table 7.2 - Command Conventions

Convention	Description
X	Address (single character 0 through 9 or A through Z; case insensitive)
*	Global address character
?	Query operator
<sp>	Space ()
n	One character place holder for digit or decimal point
n...n	Variable length field
R	Ready response

7.2.1 Password Protection

Certain commands require a password to be sent before a setting is changed. The password is only effective for the next command, so the password must be sent immediately before any password protected command string. The password string is the password set in the DPG 2400. The password is set at the factory to “0000”.

7.2.2 Response String Format

All strings sent by the DPG 2400 are terminated by a carriage return <cr> and linefeed <lf>. The DPG 2400 will return an “R” character (ASCII 82) to indicate that it has received a valid command or password rather than a query. If an invalid command or password is sent, the “R” character will not be returned. When communicating with the DPG 2400, the “R” character must be received before sending additional commands or queries. In the event that an invalid command could be sent, a timeout period of approximately one second should be used before sending the next command or query.

The full command word is shown in Table 7.2.5 “Command Set” in all capital letters. Other conventions used to describe commands are shown in Table 7.2 “Command Conventions”.

7.2.3 DPG 2400 Address

Each DPG 2400 is assigned address “1” at the factory. In a multiple unit system each device must have a unique address. Valid addresses are 0 through 9 and A through Z (upper and lower case are interpreted the same). The “A” command is used to change the address.

7.2.4 Wildcard Address Operator (*)

In addition to the 36 unique addresses available, an asterisk (*) functions as a wildcard address operator. However, the wildcard must not be used in queries if more than one device is connected to the RS-485 port.

7.2.5 Commands and Queries



Notice

Each command that changes a parameter is volatile until the SAVE command is issued.

Table 7.2.5 - Command Set

Pass-word Protect	Command / Query	Command String	Return String	Description
No	?	#X?<cr><lf>	The return string from a pressure reading query"?" can have different formats dependent upon how the unit is set up. If the peak function is disabled, the return string will only contain the current pressure reading. An example of a normal return string: 1 +14.584<cr><lf> where 1 = address, +14.584 = pressure reading, and <cr><lf> = termination. If the peak function is enabled, the return string will contain three values. The first value is the maximum pressure, the second is the present pressure and the third is the minimum pressure. An example of a return string with "peak on": 1 +14.595,+14.584,+14.575<cr><lf> where 1 = address, +14.595,+14.584,+14.575 = pressure readings, and <cr><lf> = termination.	
No	A	#XA<sp>n<cr><lf>	R	Sets address of DPG 2400 to 0-9 or A-Z.
No	CPW	#XCPW<sp>nn<cr><lf>	R	Enter customer password.
No	DC?	#XDC?<cr><lf>	X<sp>DC<sp>nnnnn	Returns the date of calibration where nnnnnn is mmddyy.
Yes	DC	#XDC<sp>nnnnnn<cr><lf>	R	Loads the date of calibration where nnnnnn is mmddyy.
No	FL?	#XFL?<cr><lf>	X<sp>FL<sp>nn	Returns the filter percentage.
No	FL	#XFL<sp>nn<cr><lf>	R	Sets the filter percentage ranges from 0 to 99.
No	FS?	#XFS?<cr><lf>	X<sp>FS<sp>nnnnn	Returns the DPG 2400 accuracy.

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No	ID?	#XID? <cr><lf>	X<sp>ID<sp>nn MENSOR,<sp>nnnn 64nn,<sp>nnnnnnnn, <sp>Vn.nn	Returns the DPG 2400 ID string.
No	NULL?	#XNULL? <cr><lf>	X<sp>NULL<sp>n	Returns mode status for null where n = 0 = OFF, n = 1 = ON.
No	NULL	#XNULL<sp>n<cr><lf>	R	Sets null mode where n = 0 = OFF, n = 1 = ON.
No	PEAK?	#XPEAK? <cr><lf>	X<sp>PEAK<sp>n	Returns mode status for peak capture where n = 0 = OFF, n = 1 = ON.
No	PEAK	#XPEAK<sp>n <cr><lf>	R	Sets peak mode where n = 0 = OFF, n = 1 = ON.
No	R-?	#XR-? <cr><lf>	X<sp>R-<sp>nnnnn	Returns minimum pressure range in PSI.
No	R+?	#XR+? <cr><lf>	X<sp>R+<sp>nnnnn	Returns maximum pressure range in PSI.
No	RST<sp>	#XRST<sp><cr><lf>	R	Resets peak values. A space must be included after the RST command.
No	SAVE	#XSAVE<cr><lf>	R	Saves all data to memory.
No	SC?	#XSC? <cr><lf>	X<sp>SC<sp>nnn nnnn	Returns the span correction multiplier.
Yes	SC	#XSC<sp>nnnnnn <cr><lf>	R	Sets the span correction multiplier.
Yes	SCPW	#XSCPW<sp>nnnn <cr><lf>	R	Changes the password.
No	T?	#XT? <cr><lf>	X<sp>T<sp>n	Returns the pressure type; A = Absolute, G = Gauge, B = Bi-directional.
No	U?	#XU? <cr><lf>	X<sp>U<sp>nn	Returns pressure units code. See Table 7.2.7.
No	U	#XU<sp>nn<cr><lf>	R	Sets the units code.
No	USR?	#XUSR? <cr><lf>	X<sp>USR<sp>nn nnnnnnnnnnnn	Returns the user unit multiplier.
No	USR	#XUSR<sp>n <cr><lf>	R	Sets user selected units. Ranges from -1.00000e+6 to -1.00000e-6 and +1.00000e-6 to +1.00000e+6.

No	UT?	#XUT? <cr><lf>	X<sp>UT<sp>n, <sp>n,<sp>n,... <cr><lf>	Returns the list of programmed pressure units.
No	UT	#XUT<sp>n<sp> N<cr><lf>	R	Loads the programmable units list. The first number is the sequential position in the list from 0 to 7 and the second number is the unit code as according to Table 7.2.7.
No	ZC?	#XZC? <cr><lf>	X<sp>ZC<sp>nn nnnn	Returns the zero offset.
Yes	ZC	#XZC<sp>nnnnn <cr><lf>	R	Sets the zero offset.

7.2.6 User Programmable Pressure Units

The remote command **UT** can be used to modify the default pressure units available on the units display screen. The user can select from one to eight units to be displayed by sending a sequence of “UT” commands. The syntax is as follows:

#*UT<sp>n<sp>n<cr><lf> where the first “n” is a value from 0 to 7 and represents the units sequential position in the displayed list. The second “n” represents the unit code from Table 7.2.7. If the first (0) unit in the sequence is assigned a value of “0” then the displayed units will default to all the available units from the factory. To display less than eight units, a “0” is assigned to the next unit in the sequence.

An example of the use of the “UT” command:

- #*UT 0 1<cr><lf> - assigns the first unit displayed as PSI
- #*UT 1 2<cr><lf> - the next unit displayed would be InHg 0C
- #*UT 2 34<cr><lf> - the third unit displayed would be hPa
- #*UT 3 0<cr><lf> - terminates the displayed units to this point
- #*UT 0 0<cr><lf> - allows all factory units to be displayed and used



Notice

The “SAVE” command must be sent to make changes permanent.

7.2.7 Pressure Units Codes and Conversions

Table 7.2.7 - Pressure Units Codes and Conversions

Code	Pressure Unit	PSI Conversion Factor
0	Counts	N/A
1	PSI	0
2	InHg 0C	2.03602
3	InHg 60F	2.041772
4	InH2O 4C	27.680672
5	InH2O 20C	27.729767
14	Bar	0.06894757
15	mBar	68.94757
17	cmH2O 4C	70.3089
19	mmHg 0C	51.71508
20	cmHg 0C	5.171508
22	kPa	6.894757
23	Pa	6894.757
26	kg/cm2	0.07030697
27	MSW 0C (@3.5% salinity)	0.6838528
34	hPa	68.94757
36	MPa	0.006894757
38	cmH2O 20C	70.4336
99	User	User Settable

8. Calibration

The DPG 2400 automatically adjusts the pressure readings for the effects of temperature within the calibrated range (see Section 4, Specifications). Thus, a calibrated DPG 2400 operated within its temperature band, and with proper zero and span settings, will provide accurate pressure measurements.

The transducer should have the span verified periodically to insure its stability. Initially, the recommended period between calibrations is as specified. This period may be extended as confidence is gained in the span stability.

8.1 Environment

Whenever possible, calibrate the DPG 2400 at the same ambient temperature as its normal operating environment. The temperature should be stable and within the specified calibration range. In addition, for maximum accuracy, see that the DPG 2400 is at rest on a stable platform which is free of vibration and shock, and oriented similar to its operating attitude.

8.2 Equipment

The following equipment is needed to calibrate a gauge transducer (see Figure 8.2):

1. A pressure source with a line-pressure regulator to cover the full scale pressure range of the DPG 2400.
2. A hand operated variable-volume pressure vernier (volume controller).
3. A metering valve and two isolating valves for Vent and Supply Pressure.
4. A pressure calibration standard.
5. Tubing and fittings adequate for the pressure range.

Additional equipment required to calibrate sub-atmospheric transducers (absolute, vacuum or bi-directional pressure types) is illustrated in Figure 8.2. These items are:

6. A vacuum pump capable of pumping down to 300 millitorr.
7. A vacuum standard to measure pressures down to 300 millitorr.
8. One additional valve to isolate the vacuum line.

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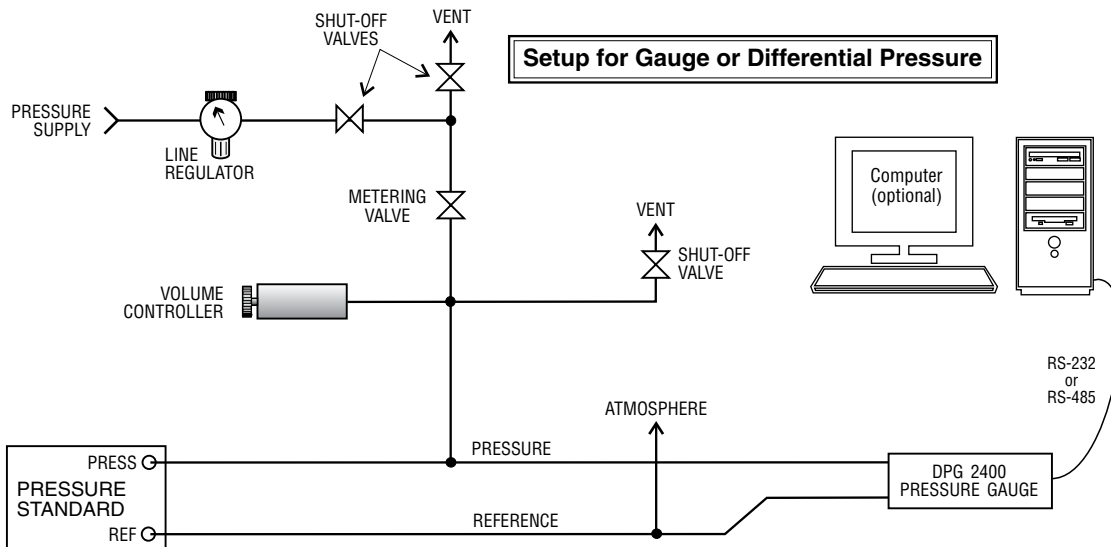
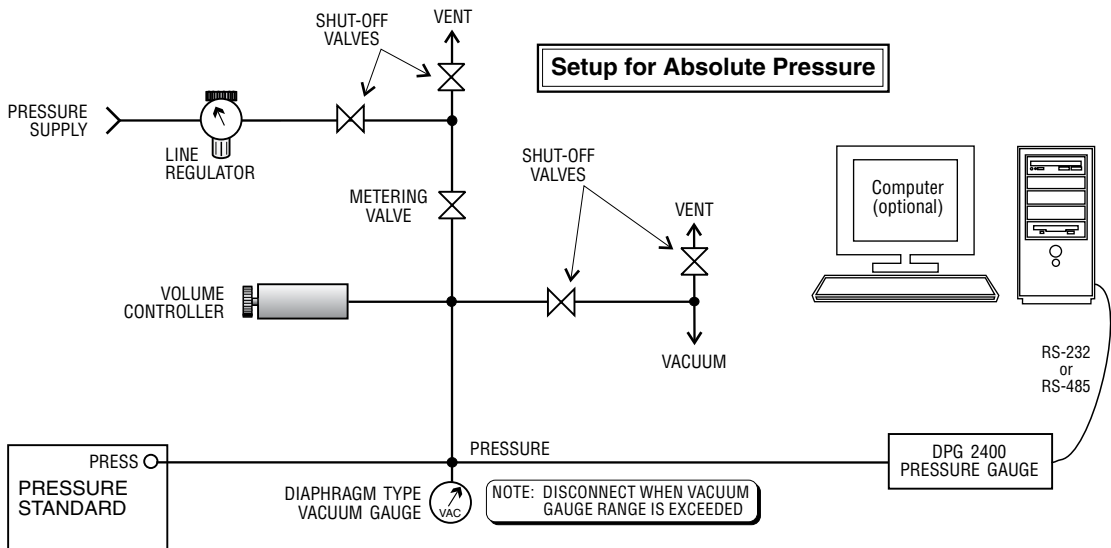


Figure 8.2 - Calibration Setup

8.3 Pressure Standard

Mensor recommends the use of appropriately accurate primary pressure standards when calibrating this instrument. Such standards should be sufficient so that when the techniques of the *ISO Guide to the Expression of Uncertainty in Measurement (GUM)* are applied, the instrument meets its accuracy statements as required by ISO/IEC 17025:2005, or other applicable standards. The same requirement applies to the vacuum gauge used to set the zero offset on absolute calibrations. The recommended absolute pressure level for setting the zero offset is ≥ 300 millitorr.

8.4 Calibration Medium

The recommended calibration medium for instrument ranges up to 2500 psi is dry nitrogen. Hydraulic media (water or oil for example) are recommended for ranges above 2500 psi. Hydraulic media can be used with some lower range instruments. However, special techniques must be used in filling the connection lines and pressure port.

8.5 Calibration Process

The calibration process described below is for local operation via the instrument keypad. Connect the DPG 2400 sensor to be calibrated as shown in Figure 8.2, Calibration Setup.

When the Calibration function is selected from the sensor setup screen, the password entry screen will be displayed. Enter the 4-digit password and then press the \blacklozenge (enter) key. For more information on entering or changing the password, see Section 6, Local Operation.

8.5.1 Zero Adjustment

Access the zero calibration screen as described in Section 6, Local Operation.

For a gauge sensor: Vent the DPG 2400 and adjust the display to show zero pressure by using the arrow keys on the front panel. When zero is shown, press the \blacklozenge (enter) key.

For an absolute sensor: Connect a vacuum source to the pressure port of the instrument. Apply a vacuum to the port and maintain a viscous flow, typically 300 millitorr, or greater. (At pressures lower than 300 mTorr, the actual pressure at any particular point in the system becomes undeterminable.) Allow sufficient time for the applied pressure to stabilize and adjust the measured pressure on the zero calibration screen to match the applied pressure. Press the \blacklozenge (enter) key to store the zero offset.

For a bi-directional sensor: Apply a negative pressure source equal to R-.

8.5.2 Span Adjustment

Access the span calibration screen as described in Section 6, Local Operation.

Apply a known pressure to the pressure port of the instrument to be calibrated equal to, or slightly less than the range of the instrument. The applied pressure must be greater than 50% of the span or span adjustments will not be accepted. Adjust the measured pressure on the span calibration screen to match the true applied pressure. Press the ♦ (enter) key to store the span offset data.

Notes



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